**Appendix 6F**

**Description of CHARM® and Examples of Fire Modeling**

# Appendix 6F


# Description of CHARM® and Examples of Fire Modeling

Radian's Complex Hazardous Air Release Model (CHARM®) provides an accurate method of assessing potential impacts from airborne releases, pool and jet fires, fireball/BLEVE's, and unconfined vapor cloud explosions. CHARM is a non-gaussian "puff" model that differentiates and integrates small source term emission puffs across time. As a puff model, CHARM is especially suited for modeling short-term accidental releases with time-varying release rates. CHARM simulates gases which are lighter-than-air, dense gases, or neutrally buoyant releases. CHARM is a chemical-specific model with an interface the AIChE DIPPR database which provides access to the physical properties of over 1,500 pure chemicals.

CHARM features extensive calculation modules which can predict initial release conditions (release rate, temperature, phase, density) based on input of containment conditions (temperature, pressure, etc.) and release size. Alternatively, initial release conditions can be input directly to CHARM for dispersion analysis. Vapor cloud explosions are simulated by invoking the overpressure or radiation effects options at any time following the simulated release. CHARM features extremely flexible output capabilities which allow the user to easily examine releases as a function of concentration, distance, and time.

CHARM is widely recognized as an accurate and easy-to-use predictive tool, and is widely accepted by various state and local regulatory agencies. The program has received excellent reviews in field validation studies conducted and documented by the EPA and AIChE[1,2,3]. Although the EPA does not sanction any specific commercial accidental release model(s), CHARM was successfully reviewed as an accurate model in a recent EPA study entitled "Evaluation of Dense Gas Simulation Models"[4]. The 1991 EPA report compared DEGADIS, SLAB, AIRTOX, CHARM, FOCUS, and TRACE models against actual observed results from release tests. The report concluded that:

> "Among the models evaluated in this study, none demonstrated good performance for all three experimental programs (all three actual test chemicals released). Different models performed more effectively for different release scenarios, reflecting the advantages and

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[1]*Evaluation of Dense Gas Simulation Models*, U.S. EPA 450/4-90-018, May 1991.
[2] *Guidelines for Use of Vapor Cloud Dispersion Models*, AICHE Center for Chemical Process Safety, 1987.
[3] *Hazardous Gas Model Evaluation with Field Observations*, "Atmospheric Environment", Hanna et. al., 1993

disadvantages of the various design features that characterize each model.  Over all three test programs, two models, CHARM and TRACE provided agreement within a factor of two for more than half of the observed and predicted maximum values, while DEGADIS and SLAB provided the best performance for (only) one experimental program."

Page 6F-3 – Austin Area Spill Scenarios – Travis, Hays Counties

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Page 6F-4 – Austin Area Spill Scenarios – Travis County

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